Nesom, G.L. 2010. Notes on *Fraxinus cuspidata* and *F. gooddingii* (Oleaceae). Phytoneuron 2010-38: 1–14. Mailed 1 September 2010.

# NOTES ON *FRAXINUS CUSPIDATA* AND *F. GOODDINGII* (OLEACEAE)

GUY L. NESOM
2925 Hartwood Drive
Fort Worth, TX 76109, USA
www.guynesom.com

## ABSTRACT

*Fraxinus cuspidata* and *F. macropetala* are distinct in leaf morphology and geography but an area of intermediacy occurs in western New Mexico and the two taxa are treated here as conspecific: *F. cuspidata* Torr. var. *cuspidata* and *F. cuspidata* var. *macropetala* (Eastw.) Sarg. Apparent foliar dimorphism has been documented throughout the range of var. *cuspidata* — the atypical leaves may occur on branches of plants with otherwise typical leaves or entire plants apparently may produce the atypical morphology. Distributions of the two varieties are mapped and lectotypes are designated for *F. cuspidata* and *F. macropetala*. A description with comments and distribution map are provided for *F. gooddingii*.

**KEY WORDS**: *Fraxinus cuspidata*, *F. macropetala*, *F. gooddingii*, Oleaceae

*Fraxinus cuspidata* Torr. has been treated to include *macropetala* Eastw. or as a variety (e.g., Kearney & Peebles 1960) or simply as a synonym (e.g., Miller 1955, Holmgren 1984). In the review here, it is observed that the difference is subtle but the two taxa are maintained as weakly differentiated geographic entities.

**FRAXINUS CUSPIDATA** Torr. in W.H. Emory, Rep. U.S. Mex. Bound. 2(1): 166. 1859. *Ornus cuspidata* (Torr.) Niewl. Amer. Midl. Naturalist 3: 187. 1914. **LECTOTYPE** (designated here): **USA. Texas. [Hudspeth Co.:]** Eagle Mountains and Great Cañon of the Río Grande, [no date], *C.C. Parry s.n.* (NY! digital image!; isolectotype: GH). Rehder (1917, p. 201) referred to this collection but not to the herbarium of deposition. The label of the lectotype has "Fraxinus cuspidata n. sp." apparently in Torrey's hand. The lectotype has only "Parry" as the collector and has no date. The GH sheet apparently notes "C.C. Parry and J.M. Bigelow" as collectors and specifies "21 Jun 1855" as the collection date.

Torrey also cited "No. 1698, Wright:" N.Mex. 1851-1852, *C. Wright 1698* (PH, US digital image!); the three GH sheets of *Wright 1698* note that it was collected in ravines near Eagle Springs, Hudspeth County, Texas. *Parry 1092*, from the "Valley of the Río Grande below Doñana" (NY! digital image!, PH), noted to be a possible type, was not among specimens cited by Torrey.

**Trees,** (2–)4–7 m; twigs cylindric; bark gray, smooth; winter buds reddish brown. **Leaves** deciduous, pinnate, 4–11 cm, spaced along distal portions of stems; leaflets subcoriaceous to thin, 5–9, glabrous or commonly hispidulous to hirsutulous on both surfaces, scaly-punctate abaxially, not papillose, blades 2.5–8 cm x (5–)1–2.3 cm, narrowly lanceolate to narrowly ovate-lanceolate, apex long-acuminate, base acute to attenuate, margins serrate with teeth drawn out to a filiform, subglandular apex, lateral petiolules 3–10 mm, winged; rachis 10–25 mm, angled and grooved but not winged; petioles 5–30 mm, bases on raised pedestals. **Flowers** bisexual (plants hermaphroditic), appearing before or with leaves, fragrant and insect pollinated; pistillate calyx present and persistent or deciduous at base of samaras; petals 4, white, united in tube 2–3 mm, lobes linear, 5–6 mm. **Samaras** 15–28 mm, body flat, hardly differentiated from wings, wings 2, arising from proximal 1/4–1/2 of body, 5–8 mm wide.

1. Leaflet apices long-acuminate ..... *Fraxinus cuspidata* var. *cuspidata*
1. Leaflet apices abruptly short-acuminate to obtuse ..... *Fraxinus cuspidata* var. *macropetala*

**Fraxinus cuspidata** var. **cuspidata** Figs. 1–4.
*Fraxinus cuspidata* var. *serrata* Rehder, Proc. Amer. Acad. Arts 53: 202. 1917. **TYPE: MEXICO. Coahuila**. Mountains E of Saltillo. 15 Apr 1880, *E. Palmer 796* (holotype: GH; isotype: US digital image!).

Flowering Apr–May(–Jul). Dry stream beds, ledges, among boulders, ravines, ledges, ridges, igneous soil, limestone, *Dasylirion-Yucca-Rhus*, acacia-sotol scrub, chaparral, oak-juniper-pine, oak-ash; (800–)1500–2300 m; New Mexico, Texas; Mexico (Chihuahua, Coahuila, Nuevo León, Tamaulipas).

**Fraxinus cuspidata** var. **macropetala** (Eastw.) Rehder, Proc. Amer. Acad. Arts 53: 201. 1917. Fig. 5. *Fraxinus macropetala* Eastw., Bull. Torrey Bot. Club 30: 494. 1903. *Fraxinus cuspidata* subsp. *macropetala* (Eastw.) E. Murray, Kalmia 12: 20. 1982. **LECTOTYPE** (designated here): **USA. Arizona**. "Yavapai Co." [**Coconino Co.**]: Rim of Grand Cañon of Colorado, "Grand View," 9 Jul 1892, *E.O. Wooton 1102* (CAS digital image!; isolectotype: NY! digital image!, US fide Rehder 1917). Eastwood also cited another collection: **Arizona. Coconino Co.**: Grand Canyon, Colorado River, Bright Angel Trail, 10 May 1903, *C.H. Merriam s.n.* (CAS digital image!).

Flowering Apr–May(–Jul). Dry stream beds, ledges, among boulders, ravines, ledges, chaparral, oak-juniper-pine, oak-ash; 1500–2300 m; Arizona, Nevada, New Mexico.

In the protologue (p. 494), Eastwood noted that "This comes nearest to [*Fraxinus*] *cuspidata* Torr., but differs in the shape of the leaves and the longer fruit which is contracted somewhat at base. The calyx is different and the divisions of the corolla are much longer." Rehder observed (1917, p. 202) that "this variety differs from the type chiefly in its 3-5, rarely 7-foliolate leaves with broader, often ovate, entire leaflets; occasionally with simple leaves at the base of the branchlets. All the other distinguishing characters given in the original description of *F. macropetala* can be found in the typical form." The current study corroborates Rehder's observation that differences between the more western *F. macropetala* and the more eastern *F. cuspidata* are consistent only in leaf morphology.

Unifoliolate leaves commonly are produced in var. *macropetala* but apparently not in the typical variety. As observed by Rehder (1917, p. 202) "On many flowering branchlets all the leaves are simple …; a sterile specimen collected … in the Sycamore Canyon has most of the leaves simple and the others with only one pair of small leaflets at the base."

**Vegetative dimorphism in *Fraxinus cuspidata*.**

Vegetative dimorphism in *Fraxinus cuspidata* has been a source of confusion for some (initially including the present author) and has led to misidentifications. In fact, the atypical, small-leaved variant has been the basis of previous reports of the occurrence of *F. greggii* in New Mexico (e.g., Martin & Hutchins 1980; USDA, NRCS 2010). The variant is represented in collections by branches with leaves much smaller and differently shaped (Figs. 2–4) than typical of the species. Another unusual variant, apparently, produced obtrullate-obovate leaves rounded and shallowly toothed at the apices (*Palmer 30928*, from Jeff Davis Co., Texas).

Rehder (1917, p. 201) observed that "Shrubs with rather densely pubescent and at the same time smaller and broader leaflets apparently represent merely a juvenile form, as I found such foliage

only on stunted shrubs without fruit; only once I found a slightly pubescent shrub with a few fruits. Pringle has also distributed sterile branches with pubescent leaves under his number 137 from the Santa Eulalia Mountains in Chihuahua" (see Fig. 2).

U.T. Waterfall observed the same phenomenon on collections he made in 1943 from Hudspeth County, Texas: "Note striking dimorphism revealed by #4797 and #4798, both from the same tree." The atypical variant (4798, as cited above) was collected from "lower and inner branches … from [the] same tree as 4797." At nearly the same locality, Rogers McVaugh made a similar collection in documentation of the dimorphism, noting that it occurred on a single tree —his *7357* bears a nearly typical branch and an atypical one, on *7357a* only a large branch with atypical leaf morphology. McVaugh's *8036* from Hudspeth County also explicitly notes that the dimorphism occurs on a single tree.

On the other hand, collections that bear only the typical morphology suggest that it also may be the only form produced by some trees. Further, branches with the variant morphology are not necessarily sterile; for example, *Read A-479* (Culberson Co., Texas; Fig. 3) and *Heil & Clifford 14417* (McKinley Co., New Mexico; Fig. 4) are fertile pistillate branches.

Miller (1955) called attention to Waterfall's #4797 and #4798 (comments above), noting that the variability might be regarded as analogous to the difference between typical *F. cuspidata* and *F. macropetala*, in justification of complete synonymy of the latter. "There is certainly small point in assigning a Latin name at one extreme of a variation when the total range of variation can be found in a single tree." A possible element of homology underlying the similarity between *F. macropetala* and the atypical variants of typical *F. cuspidata* seems plausible. The collection by *Heil & Clifford 14417* (McKinley Co., New Mexico; Fig. 4), which probably is an expression of var. *macropetala*, is comparable to atypical variants of var. *cuspidata*.

Collections examined of the atypical leaf form of *Fraxinus cuspidata*: **New Mexico. Dona Ana Co.**: Feeder Canyon, Upper Ash Canyon, San Andres Mountains, 23 Oct 1975, *Von Loh 741* (UNM), *742* (UNM). **Hidalgo Co.**: Thompson Canyon, Big Hatchet Mts., 19 Aug 1954, *Castetter 9507* (UNM); Thompson Canyon, Big Hatchet Mts., 7 Sep 1952, *Dittmer 6900* (UNM). **McKinley Co.**: S of Ft. Wingate, 1 mi S of Forest Service boundary on road 400, 14 Sep 1976, *Manthey 1417* (UNM). **Valencia Co.**: *Baca 241* (UNM). **Texas. Brewster Co.**: mid slopes Nine-Point Mesa, 65 mi S of Alpine, igneous soil, 4200 ft, infrequent shrub, 3 Jul 1959, *Warnock & Johnston 17441* (SRSC, fide Mike Powell). **Culberson Co.**: Sierra Diablo Mountains, Wild Rose Canyon, Victoria Wildlife Management Area, 13 Jun 1973, *Sikes & Smith 579* (LL); Sierra Diablo Refuge, ca. 2.5 mi NW of headquarters, South Fork of Victoria Canyon, 5000 ft, 20 Oct 1962, *Read A-479* (SRSC digital image!). **Hudspeth Co.**: Sierra Diablo, upper (limestone) slopes of Victoria Canyon, near Vivian McAdoo Ranch, ca. 30 mi N of Allamoore, 10 Jul 1945, *McVaugh 7357 and 7357a* (MO, SMU); N end of Quitman Mts., 8 mi W of Sierra Blanca, steep rocky (igneous) slopes, abundant in canyon, leaflets dimorphic, those on sterile branchlets broad & obtuse, 21 Apr 1947, *McVaugh 8036* (TEX); Sierra Diablo, Victoria Canyon near its upper end, 29 Jun 1943, *Waterfall 4798* (NY). **Jeff Davis Co.**: Davis Mts., deep rocky canyon, along bed of stream, 15 Jun 1926, *Palmer 30928* (MO); Davis Mts., E of Mt. Livermore, in deep rocky canyon, 4 Jun 1928, *Palmer 34344* (MO). **Presidio Co.**: Chinati Mtns. State Natural Area, Upper Cinco de Mayo Canyon, parallel and to W of San Antonio Canyon, bouldery slopes of N-S trending canyon, even-grained, "composted granite" red substrate in the drainage bottom, Gray oak woodland with *Baccharis glutinosa*, *Brickellia laciniata*, *Ungnadia speciosa*, *Viquiera stenoloba*, *Rhus virens*, *Prosopis*, *Celtis*, *Opuntia imbricata*, *Aloysia wrightii*, *Garrya*, and *Fraxinus*, elev. 4322 ft., shrub 1 m tall in dense shade, 16 Sep 2004, *Lott 5302* (TEX). **Mexico**: **Chihuahua**. Barranca del Cobre, south wall, 27° 30'N, 107° 34'W, along river bed and up ravines, in cliffs, and along screes, 3500–4000 ft, 20 ft tall, usually several trunks clustered, 20 Feb

1945, *Hewitt 18* (GH); Santa Eulalia Mts., 6 Apr 1885, *Pringle 137* (NY); Santa Eulalia Mts., 13 Apr 1886, *Pringle 851* (NY). **Coahuila**. Mpio. Ramos Arizpe, Sierra de la Paila, Ejido el Cedral por el cañón El Carmen, 25° 58' N, 101° 32' W, bosque esparcidos de *Quercus glaucoides*, *Q. gravesii*, *Pinus arizonica* y *Juniperus flaccida*, suelo calcareo, 1300–1600 m, 16 Jun 1980, *Castillo Q. & Aguilera 773* (TEX).

A collection from the state of Jalisco, in a natural habitat but apparently far out of range for *Fraxinus cuspidata*, appears to be that species but it needs to be reexamined. **Jalisco**. Barranca of Guadalajara, 10 Jul 1894, *Pringle 5886* (GH).

**FRAXINUS GOODDINGII** Little, J. Wash. Acad. Sci. 42: 373. 1952. **TYPE: USA. Arizona. Santa Cruz Co.**: Patagonia Mts., Sycamore Canyon, steep rocky slopes, 4000–5000 ft., 15 May 1936, *L.N. Goodding s.n.* (holotype: US, digital image!; isotype: US, digital image!).

**Shrubs or small trees**, 1.5–4 m; twigs terete; bark smooth, gray, with large scales; winter buds brownish. **Leaves** persistent or mostly so, pinnate, 2.5–6.5 cm, mostly clustered (fascicled) at tips of spur shoots; leaflets subcoriacous, (3–)5–7(–9), glabrous on both surfaces, rarely short-hirsute with curved hairs, glossy adaxially, densely scaly-punctate abaxially, not papillose, blades (0.8–)1–2 cm x (0.4–)0.5–1.4(–1.8) cm, broadly elliptic, elliptic-obovate, or elliptic-ovate to ovate, elliptic-lanceolate, or lanceolate, apex acute to obtuse or rounded, rarely acuminate, base acute to obtuse, rounded, or truncate, margins subentire or usually crenate to crenate-serrate with 1–4 pairs of teeth on the distal half; lateral petiolules 0(–2) mm (leaflets sessile to subsessile), winged; rachis 15–50 mm, narrowly winged; petiole bases on raised pedestals, sometimes with tawny-viscid hairs. **Flowers** bisexual and unisexual (species polygamous), appearing before or with leaves, wind pollinated; pistillate calyx present and persisting at base of samaras; petals absent. **Samaras** 11–16(–20) mm, body cylindric to subcylindric, wings 2, arising from proximal 1/3 to distal 1/3 of body, 3–4 mm wide.

Flowering Feb–Apr. Rocky slopes, cliff bases, arroyos, canyons, limestone, oak and oak-pine woodland, desert scrub; 1100–1700 m; Arizona; Mexico (Sonora, including Isla Tiburón).

Felger et al. (2001, p. 261) described the general aspect of *Fraxinus gooddingii*: "Usually shrubby, often a small, multiple-trunked tree 7-8 m with an upright growth habit and slender twigs. … Often evergeen, or the leaves yellowing and falling in early spring at flowering time, and new leaves appearing with the flowers or later in spring, or sometimes winter deciduous during cold weather."

"*Fraxinus gooddingii* is distinguished from the closely related species *F. greggii* by the following characteristics: (1) twigs, buds, and petioles densely and minutely tomentose with multiradiate fulvous hairs, instead of young twigs slightly gray puberulent; (2) leaflets more numerous, 5–9, commonly 7, instead of 3–7 (or 1); (3) leaflets elliptical, broader and thinner, usually acute at apex, often slightly puberulent beneath, obtuse at apex, glabrous except for the minute peltate hairs; (4) leaflet margin flat or slightly reflexed, crenulate or serrulate above middle, instead of reflexed, entire or crenulate; (5) wing of fruit decurrent nearly to base, instead of slightly decurrent at upper end" (Little 1952, p. 375).

Particularly diagnostic of *Fraxinus gooddingii* (compared to species it might be confused with in sterile form, *F. greggii* and *F. cuspidata*) is the close, flocculent vestiture of tiny, white, multiradiate hairs on young twigs, buds, and petioles. The other species, at the same places, do not produce multiradiate hairs but instead have a sparse (to dense) covering of sessile to short-stipitate, orange, glandular, peltate scales. In *F. gooddingii*, also, the petiole, rachis, and abaxial midvein sometimes are densely hirtellous-villous with white hairs. *Fraxinus gooddingii* is apetalous and its

terete-bodied fruits are more similar to those of *F. greggii* than to *F. cuspidata*. Fruits of *F. gooddingii* and *F. cuspidata* are contrasted in Figure 6.

The molecular study by Wallander (2008) confirmed the hypothesis of close relationship between *Fraxinus gooddingii* and *F. greggii*. Their consistent differences are summarized in the following couplet.

1. Leaves mostly clustered at tips of spur shoots; leaflets 5–7(–9), subcoriacous, ovate to elliptic or elliptic-lanceolate, apex acute to obtuse or sometimes acuminate, margins subentire to crenate-serrate with 1–4 pairs of teeth on the distal half; rachis 15–50 mm long; young twigs, buds, and petioles with close, flocculent vestiture of tiny, white, multiradiate hairs; fruit bodies subterete to terete ..... *Fraxinus gooddingii*

1. Leaves spaced along distal portions of stems; leaflets (1–)3–5, coriaceous, oblanceolate or obovate to rhombic-elliptic or elliptic, apex rounded, margins entire or shallowly crenate with 1–3 pairs of teeth on the distal half; rachis (0–)3–15(–22) mm long; young twigs, buds, and petioles with sparse covering of sessile to short-stipitate, orange, glandular, peltate scales; fruit bodies distinctly flattened ..... *Fraxinus greggii*

Collections examined and mapped: **USA. Arizona. Cochise Co.**: Dragoon Mountains, Slavin Gulch, ca. 18 km (by air) ESE St. David, 31.8802800 - 110.0230600, 1492m, 2 May 2010, *Katcher s.n.* (ARIZ fide SEINET); Whetstone Mountains, French Joe Canyon, 17.5 km (by air) SSW Benson, 31.8101 - 110.3939, rocky canyon bottom, 1575 m, 24 April 2010, *Van Devender s.n.* (ARIZ fide SEINET); ca. 6 mi W of New Mexico border in foothills of the Guadalupe Mountains, 31.3711000 - 09.1574000, locally scattered on NW-facing limestone slope, *Mortonia, Rhus, Acacia, Opuntia, Fouquieria,* Chihuahuan Desert, 1350m, 26 May 1981, *Yatskievych 81-186* (ARIZ fide SEINET). **Santa Cruz Co.**: Tumacacori Mts., Rock Corral Spring, 3800 ft, 9 Jun 1979, *Fletcher 3900* (UNM); Peña Blanca Mts., 3 May 1935, *Goodding 4751* (NY); rocky north-facing ledges and slopes above small canyon, about 1/2 mile north of Rock Corral Cayon, Atascosa Mountains, west of Tumacacori (2.1 miles west of Interstate 19), Semidesert grassland, 3750 ft, 8 Dec 1989, *Johnson 89-185* (GH); Coronado National Forest, Sycamore Canyon, 16 mi WNW of Nogales, oak woodland, 4100 ft, 30 Jun 1956, *Little 17075* (GH); Coronada Natl. Forest, S of Peña Blanca Recreation Area, Ariz. Rte. 289, grassland with *Quercus emoryi, Q. oblongifolia, Arctostaphylos pungens, Rhus choriophylla*, shrub or small tree 1-5 m tall, 8-9 Sep 1976, *McGill & Lehto L20365* (NY). **MEXICO. Sonora**. Along road between Colonia Morelos and Colonia Oaxaca, about 8 mi from Colonia Morelos, 24 Apr 1981, *Bowers s.n.* (ARIZ fide SEINET); Sierra de los Ajos, 17.8 mi by road N of Bacoachic, SE of Cerro La Cieneguita, on steep SE-facing slope above canyon bottom in oak woods with *Eysenhardtia orthocarpa, Garrya wrightii, Rhus choriophylla, Ipomoea longifolia, Muhlenbergia*, and *Dalea versicolor* 25 Jul 1993, *Fishbein 1249* (ARIZ fide SEINET, TEX); Sierra de los Ajos, SE trending tributary of Cañon Hondo, 1 km SE of Cerro La Cieneguita, about 3.7 mi N of Rancho La Volanta, 22 Apr 1995, *Fishbein s.n.* (ARIZ fide SEINET); Mpio. Magdalena de Kino, Magdalena, Rancho la Tinaja Colorada, unos 15 km al NE de Magdalena de Kino, 11 Aug 1996, *Flores M. s.n.* (ARIZ fide SEINET); 6.3 mi E of bridge at Huasabas, rocky slope, small tree ca 3 m high, ca 4200 ft, 23 Feb 1987, *Landrum 5443* (TEX); Sierra Baviso, 17 mi SE of Magdalena, on road to Cucurpe, S of the Palm Canyon, 19 Mar 1978, *McCarten s.n.* (ARIZ fide SEINET); Sierra Baviso, 17 mi SE of Magdalena on road to Cucurpe, Palm Canyon, 19 Mar 1978, *McCarten s.n.* (ARIZ fide SEINET); 9 mi E of Esqueda, along road to Angostura Playa, 8 Sep 1961, *Mason s.n.* (ARIZ fide SEINET); S-facing side canyon ca 1 mi upstream from road entrance to Cajon Bonito, 1 May 1976, *Mason 3189* (ARIZ fide SEINET, NY!); Palm Canyon, 19 mi E of Magdalena along the road to Cucurpe, 25 Jun 1977, *Mason s.n.* (ARIZ fide SEINET); region of the Río de Bavispe, Canon del Temblor, 24 Aug 1940, *Phillips 736* (ARIZ fide SEINET, GH); 5.8 mi E of Río de Bavispe by Huasabas to El Coyote and Huachinera road, on the rim of the Cruce del Diable, 18 Mar 1979,

*Reichenbacher s.n.* (ARIZ fide SEINET); Sierra La Madera, 2.5 miles by dirt road, northwest of Los Remedios at Arroyo Remedios and 9.3 miles by dirt road east-northeast of Ímuris, 20 Sep 1982, *Reichenbacher 1181* (ARIZ fide SEINET); Sierra La Madera, 2.2 miles by microwave tower road, NW of tower turnoff, 6.5 miles by microwave tower road E of Mex Hwy 15 & 2 at Ímuris, 22 Sep 1982, *Reichenbacher 1243* (ARIZ fide SEINET); Mpio. Agua Prieta, isolated hill NE of Sierra Anibacachi, Rancho La Calera, ca. 10 km (by air) SW of Agua Prieta, Chihuahuan desert scrub on limestone, 1287 m, 10 Apr 2003, *Reina G. 2003-370* (TEX); 11.6 km al NE de Ímuris, sobre Mexico 2, cañada El Corral, 12 Aug 1995, *Reina G. s.n.* (ARIZ fide SEINET); 11 mi W of Cucurpe, 13 Sep 1934, *Shreve s.n.* (ARIZ fide SEINET); Dead Bull Canyon, near Arizpe, 17 Mar 1982, *Thompson s.n.* (ARIZ fide SEINET); 1.6 mi (by road) S of Imuris, 16 Apr 1964, *Turner s.n.* (ARIZ fide SEINET); 2 mi (by road) E of Colonia Oaxaca, 3 Oct 1965, *Turner s.n.* (ARIZ fide SEINET); ca. 34 roadmiles E of turnoff of Sonora, Hwy 12 at Esqueda on road to El Tigre, 30 Jan 1982, *Van Devender s.n.* (ARIZ fide SEINET); Mpio. Santa Ana, Santa Ana, Rancho El Otate, Arroyo Los Otates, 30° 17' 55" N, 110° 52' 32" W, locally common 2-2.5 m shrub, rocky slope, 12 Apr 1998, *Van Devender 98-430* (ARIZ fide SEINET, NY, TEX); Mpio. Fronteras, Rancho Carro Quebrado, 10.3 km SE of Esqueda on road to La Playa and Rio Bavispe Valley, 1219 m, 11 Apr 2003, *Van Devender 2003-440* (TEX); Mpio. Nacori de Garcia, Nacori de Garcia, 1134 m, 13 Apr 2003, *Van Devender 2003-528* (TEX); Mpio. Agua Prieta, Cerro El Caloso (= Calichoso) S of Rancho San Marcos, ca 8 km (by air) E of Caballona, 1272 m, 17 Apr 2007, *Van Devender 2007-427* (TEX); Huasabas, Km 223 NE of Huasabas, 10 May 1992, *Walker s.n.* (ARIZ fide SEINET); 5 mi N of Fronteras, Hacienda de San Rafael, region of the Río Bavispe, 3800 ft, shrub 4 m, 9-12 Aug 1941, *White 3880* (ARIZ fide SEINET, GH, NY, TEX); Sierra de la Cabellera, Cañon de la Bellota, region of the Río Bavispe, 4300 ft, shrub 5 m, 7-10 Oct 1941, *White 4674* (ARIZ fide SEINET, GH, NY).

Wilder et al. (2007) have documented the presence of *Fraxinus gooddingii* on Sierra Kunkaak of Isla Tiburón, disjunct far to the west of the main range of the species. Similar to *Canotia holocantha* Torr. (and others) on Isla Tiburón (Wilder et al. 2008), the presence of the ash there is hypothesized to be relictual from a broader Pleistocene distribution. **MEXICO**. **Sonora**. Isla Tiburón, deep canyon beyond Simmen Haax waterhole, 25 Oct 2007, *Felger 07-116* (ARIZ fide SEINET); Isla Tiburón, deep canyon beyond Simmen Haax waterhole, 25 Oct 2007, *Felger 07-121* (ARIZ fide SEINET); Isla Tiburón, deep canyon in the northern interior of the Sierra Kunkaak, 26 Oct 2007 *Wilder 07504* (ARIZ fide SEINET).

Records of many other collections of *F. gooddingii* from Santa Cruz Co., Arizona, can be found on SEINET (2010).

## ACKNOWLEDGEMENTS

I am grateful to Mike Powell (SRSC) for information and images of trans-Pecos ashes, to Néstor Pérez-Molière for images of NY specimens, Toml Wendt for the image of the TEX specimen of *Fraxinus gooddingii*, Benjamin Brandt for information on specimens at ARIZ, Richard Felger and Ben Wilder for comments on the presence of *F. gooddingii* on Isla Tiburón, Eva Wallander for comments, and to staff at BRIT-SMU, GH, NY, SJNM, TEX-LL, and UNM for hospitality during my studies there. I happily acknowledge that Jim Henrickson's justifiable skepticism preceded my understanding of variation in *F. cuspidata*. This study was done in part under contract for the Flora of North America Association, in conjunction with preparation of the FNANM treatment of *Fraxinus*.

## LITERATURE CITED

Felger, R.S, M.B. Johnson, and M.F. Wilson. 2001. The Trees of Sonora, Mexico. Oxford Univ. Press, New York.

Holmgren, N.H. 1984. Oleaceae. Pp. 339–344 *in* A. Cronquist et al. (eds.). Intermountain Flora, Vol. 4. The New York Botanical Garden, Bronx, New York.

Kearney, T.H. and R.H. Peebles. 1960. Arizona Flora (ed. 2 with supplement). Univ. of California Press, Berkeley.

Little, E.L., Jr. 1952. Notes on *Fraxinus* (ash) in the United States. J. Wash. Acad. Acad. Sci. 42: 369–380.

Martin, W.C. and C.R. Hutchins. 1980. A Flora of New Mexico. J. Cramer, Vaduz, Germany.

Miller, G.N. 1955. The genus *Fraxinus*, the ashes, in North America, north of Mexico. Agric. Expt. Sta. Mem. 335, Cornell Univ., Ithaca, New York.

Nesom, G.L. 2010. Geography of unifoliolate taxa of *Fraxinus* (Oleaceae). Phytoneuron 2010-17: 1–6.

Rehder, A. 1917. The genus *Fraxinus* in New Mexico and Arizona. Proc. Amer. Acad. Arts 53: 199–212.

SEINET. 2010. Southwest Environmental Information Network. Arizona State University and partners. <http://swbiodiversity.org/seinet/index.php> Accessed 30 July 2010.

USDA, NRCS. 2010. The PLANTS Database. United States Department of Agriculture, Natural Resources Conservation Service, National Plant Data Center, Baton Rouge, LA. <http://plants.usda.gov> Accessed 30 July 2010.

Wallander, E. 2008. Systematics of *Fraxinus* (Oleaceae) and evolution of dioecy. Plant Syst Evol 273: 25–49.

Wilder, B.T., R.S. Felger, H. Romero-Morales, and A. Quijada-Mascareñas. 2007. New plant discoveries for Sonoran Islands, Gulf of California, Mexico. J. Bot. Res. Inst. Texas 1: 1203–1227.

Wilder, B.T., R.S. Felger, and T.R. Van Devender. 2008. *Canotia holacantha* on Isla Tiburón, Gulf of California, Mexico. Canotia 4: 1–7.

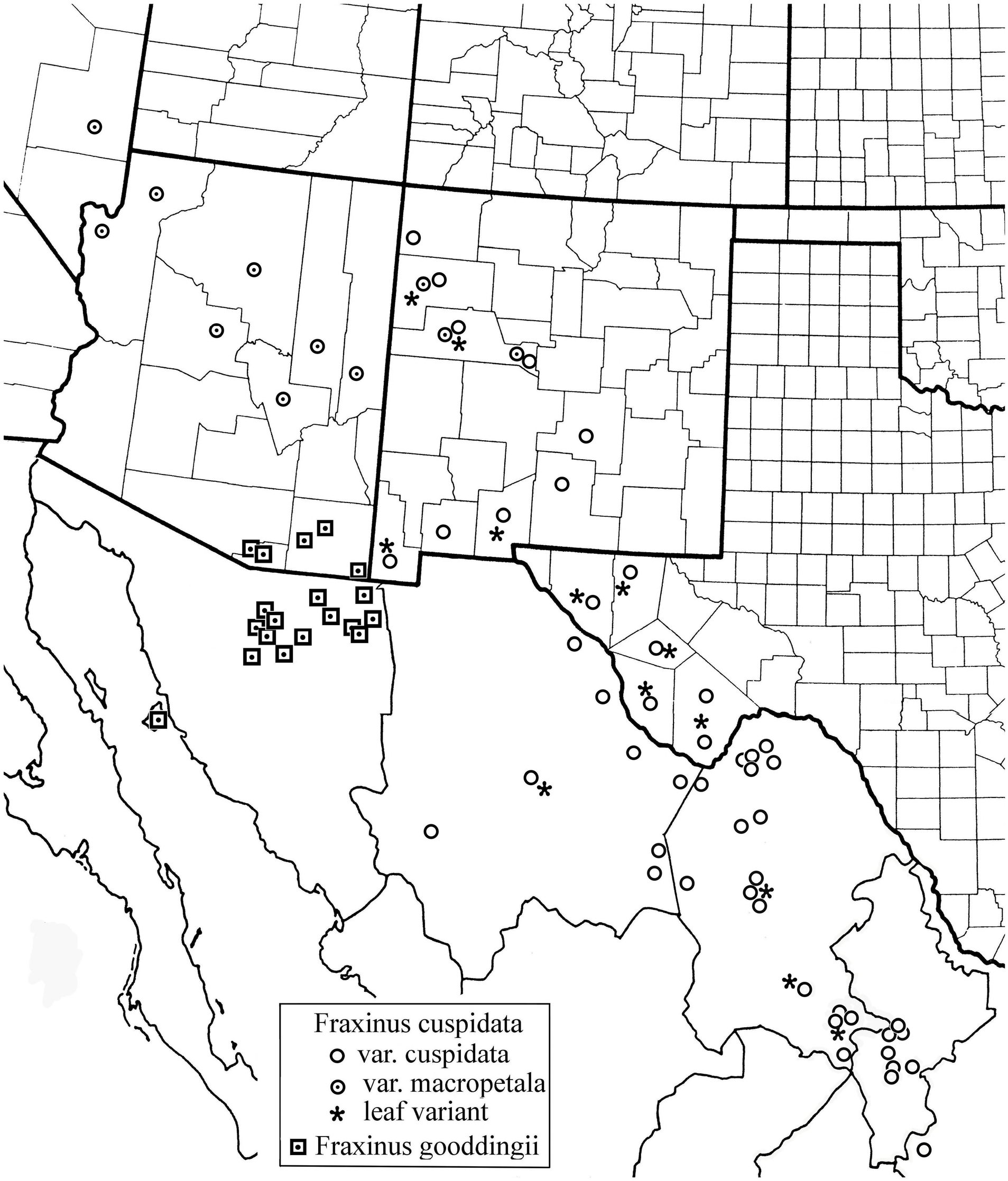


Figure 1. Geographic ranges of *Fraxinus cuspidata* (var. *cuspidata* and var. *macropetala*) and *F. gooddingii*. Intermediates are common in counties where symbols are placed for both varieties of *F. cuspidata*. Collection localities of atypical variants of *F. cuspidata* (see text) are indicated. Records are mostly from TEX-LL, UNM, and ARIZ. Some have been added from SEINET, especially for *F. gooddingii* in Mexico (see text).

Figure 2. Collection of *Fraxinus cuspidata* var. *cuspidata* showing dimorphism (*Pringle 137*, NY).

Figure 3. Collections of atypical (small-leaved) *Fraxinus cuspidata* var. *cuspidata* in fruit (*Read A-479*, SRSC).

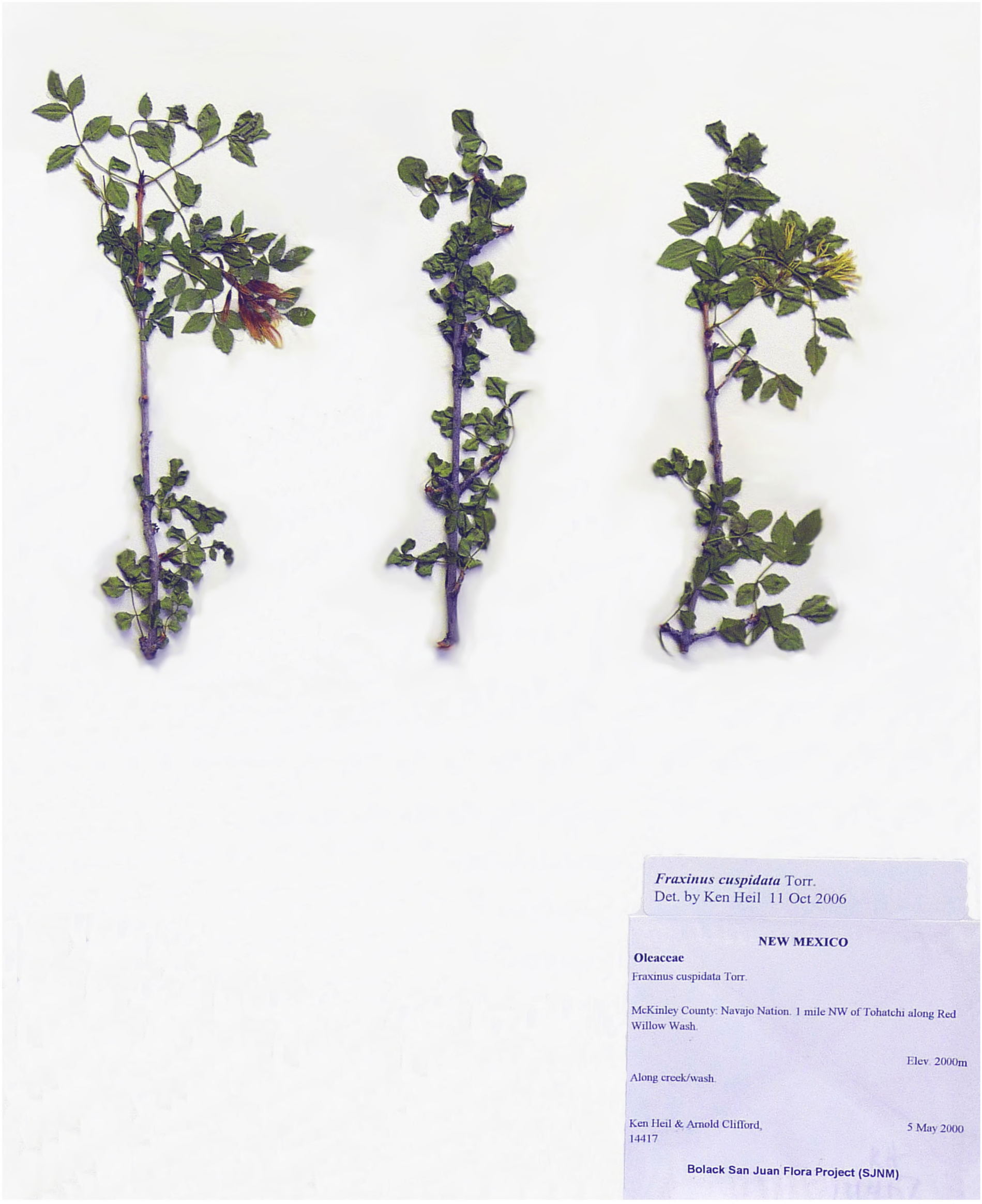


Figure 4. Collection of near (?) typical *Fraxinus cuspidata* var. *macropetala* in flower (*Heil & Clifford 14417,* SJNM).

Figure 5. Collection of typical *Fraxinus cuspidata* var. *macropetala* (*Atwood 25883*, SJNM).

Figure 6. Collection of typical *Fraxinus gooddingii* (*Van Devender 2007-427*, TEX).

Fig. 7. Samaras of *Fraxinus cuspidata* (A) and *F. gooddingii* (B). (From SEINET 2010).